2.5 Signals and Systems Problems

Problem 2.1: Complex Number Arithmetic

Find the real part, imaginary part, the magnitude and angle of the complex numbers given by the following expressions.

1. -1
2. $\frac{1+\sqrt{3}j}{2}$
3. $1+j+e^{j\frac{\pi}{2}}$
4. $e^{j\frac{\pi}{3}}+e^{j\pi}+e^{-(j\frac{\pi}{3})}$

Problem 2.2: Discovering Roots

Complex numbers expose all the roots of real (and complex) numbers. For example, there should be two square-roots, three cube-roots, etc. of any number. Find the following roots.

1. What are the cube-roots of 27? In other words, what is $27^{\frac{1}{3}}$?
2. What are the fifth roots of $3\left(3^{\frac{1}{5}}\right)$
3. What are the fourth roots of one?

Problem 2.3: Cool Exponentials

Simplify the following (cool) expressions.

1. j^{j}
2. j^{2j}
3. $j^{j^{j}}$